IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application of

Masashi OTSUKI et al.

Application No. 10/048,054

Filed: January 25, 2002

For: NON-AQUEOUS ELECTROLYTE SECONDARY CELL

Group Art Unit: 1752

Examiner: Hoa Van Le

DECLARATION UNDER 37 C.F.R. § 1.132

Honorable Commissioner of Patents and Trademarks

Washington, D.C. 20231

Sir:

I, Masashi OTSUKI, do declare and state as follows:

I graduated from the Graduate School of Osaka University, Faculty of Engineering, Department of Chemical Process Engineering with a Doctoral Degree in Engineering in March 1994;

I joined Bridgestone Corporation in April 1994, and since that time, I have been engaged in research and development in the fields of electrochemistry and polymer chemistry;

I am a co-inventor of the subject matter disclosed and claimed in the above-identified application; and

I am familiar with the Office Action of January 5, 2005 and understand that the Examiner has rejected claims 1-20.

The following additional comparative experiment was carried

out under my supervision in order to make the advantages of the subject matter of the amended claims of the present invention more clear.

Experiment: Evaluation of properties of Phosphazene derivative and Non-aqueous Electrolyte using the same

Phosphazene derivative compounds designated as Examples 16 to 21 and Comparative Examples 7 to 9 respectively having the chemical structures shown in the following Table 5 were prepared, and flash points thereof were measured in accordance with American Society for Testing and Materials (ASTM) Standards D56 and D93. When there was no flash point for an example (namely, the example did not catch fire), the flash point of the example was determined to be "unobserved". Further, flammability of the above Examples and Comparative Examples was measured in the same manner as described in EXAMPLES in the specification of the present application. Furthermore, non-aqueous electrolytes, each of which were prepared by adding 10 % by volume of any one of Examples 16 to 21 and Comparative Examples 7 to 9 to a mixture of ethylene carbonate and ethylmethyl carbonate (in a mixing ratio of ethylene carbonate : ethylmethyl carbonate of 1:4 by volume) containing 1 mol/L of $LiPF_6$, were measured for ionic conductivity thereof. The results of the measurements are shown in Table 5 together with viscosity of each of the phosphazene derivative compounds of Examples 16 to 21 and Comparative Examples 7 to 9.

Table 5

	Chemical structure and Substituent R^a (ratio)※	Flash point (°C)	Flammability	Viscosity (mPa·sec)	Ionic conductivity (S/m)
Example 16	Formula (1) ※※ R^1, R^2 and R^3: F R^4 and R^5: E	Unobserved	Non-flammable	3.8	0.76
Example 17	Formula (2) (n = 3) Four R^4: F Two R^4: E※※※	Unobserved	Non-flammable	1.3	1.01
Example 18	Formula (2) (n = 3) Five R^4: F One R^4: E	Unobserved	Non-flammable	1.1	1.06
Example 19	Formula (2) (n = 3) Five R^4: F One R^4: Ph	Unobserved	Non-flammable	1.7	0.96
Example 20	Formula (2) (n = 3) Five R^4: F One R^4: Pr	Unobserved	Non-flammable	1.1	1.05
Example 21	Formula (2) (n = 3) Five R^4: F One R^4: Tf	Unobserved	Non-flammable	1.8	0.95
Comparative Example 7	Formula (1) ※※ R^1, R^2 and R^3: Tf R^4 and R^5: E	156	Flame-retardant	35	Less than 0.45
Comparative Example 8	Formula (2) (n = 3) All R^4: Pr	192	Self-extinguishable	60	Less than 0.38
Comparative Example 9	Formula (2) (n = 3) All R^4: Pf	About 250	Self-extinguishable	100	(currently no available data)

※ F: Fluorine atom; E: Ethoxy group; Ph: Phenoxy group; Pr: Propoxy group; Tf: Tetrafluoroethyl group; Pf: Pentafluoropropoxy group

※※ In Formula (1), each of Y^1, Y^2 and Y^3 is a single bond.

※※※ Two R^4s, which substitute on the same phosphorus atom, do not represent ethoxy groups simultaneously.

As is understood from the results for Examples 16 to 21, the phosphazene derivative compounds of the present invention, which have a structure in which at least one substituent bonded to a

phosphorus atom is a halogen atom (fluorine atoms are used in the above Examples), are non-flammable, which imparts safety to cells which use the phosphazene derivative compounds. Further, the ionic conductivity of the non-aqueous electrolytes using the phosphazene derivative compounds of the present invention is high enough to satisfy the requirements for use in recent electronic devices which need a large amount of electric current. In contrast, the phosphazene derivative compounds of Comparative Examples 7 to 9, which have a structure in which all substituents bonded to a phosphorus atom are organic groups, have flash points (namely, they catch fire when a flame is contacted thereto) and cannot impart safety to cells which use such comparative phosphazene derivative compounds. Further, the ionic conductivity of the non-aqueous electrolytes using the comparative phosphazene derivative compounds is too low to satisfy the requirements for use in recent electronic devices which need a large amount of electric current.

I further declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true, and further, that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

DATE: April 28, 2005

Masashi OTSUKI